

Serial No.: 10/812,172

Filing Date: 3/30/2004

Attorney Docket No. H0005492-5836/400.318US01

Title: SYSTEM AND METHOD FOR MULTIPLEXING AND TRANSMITTING DC POWER, IMU DATA AND RF DATA ON A SINGLE CABLE

REMARKS

Applicant has reviewed the Office Action mailed on June 29, 2006 as well as the art cited. Claims 5, 6, 9, 14 and 16 are currently amended by this response to better clarify the allowable subject matter. Claim 20 is newly presented to claim material disclosed in the original specification. No new material has been introduced through these amendments. Claims 1-20 are pending in this application.

Summary of Examiner Interview

The Applicants' representative, Joseph Kendrick (Registration Number 53,109) thanks Examiner Tuan To for the opportunity to discuss aspects of this case in a telephone interview on September 15, 2006.

The claims were discussed with respect to the Examiner's rejection of claims 1-7 under 35 USC § 103(a) as being unpatentable over Groves (U.S. Patent Publication No. 2004/0012522) in view of Kain et al. (U.S. Patent No. 5,894,323), claim 8 under 35 USC § 103(a) as being unpatentable over Groves (U.S. Patent Publication No. 2004/0012522) in view of Sagem (EP Patent No. 820158A1), and claims 9-19 under 35 USC § 103(a) as being unpatentable over Lin (U.S. Patent Publication No. 2002/0062193) in view of Lin (U.S. Patent Publication No. 2001/0020216).

During the interview, Applicants' representatives asserted that, with respect to claims 1-8, Groves did not teach supplying direct current (DC) power to an IMU over a cable and simultaneously transmitting RF position data and IMU data to a processor over that same cable and that the Examiner had not demonstrated how Kain and/or Sagem cures this defect of Groves. With respect to claims 9-19, Applicants' representatives asserted that Lin (U.S. '193) did not teach a filter configured to pass DC power from a cable while precluding the DC power from reaching a GPS antenna while passing IMU data and GPS radio frequency energy to the same cable, and that Lin (U.S. '216) did not cure this defect of (U.S. '193). The Examiner and the Applicants' representatives discussed potential amendments to independent claims 9 and 16 and the Examiner agreed to further consider Applicant's arguments included in the next office

action response. In addition, the Examiner and the Applicants' representatives discussed using the examiner's suggested language of "configured to" with respect to the amended claims.

Applicants believe that the substance and scope of the telephone interview of September 15, 2006 is accurately captured in the summary above and the arguments below.

Rejections Under 35 U.S.C. § 103

Claims 1-7 were rejected under 35 USC § 103(a) as being unpatentable over Groves (U.S. Patent Publication No. 2004/0012522) in view of Kain et al. (U.S. Patent No. 5,894,323).

The Examiner refers to Groves and asserts that "Groves discloses a system for enhancing navigation systems that comprises a processor (Groves, page 1, paragraph 2, line 3), an IMU collocated with a GPS receiver (Groves, page 1, paragraph 2, lines 1-6; paragraph 9, lines 1-4)." The examiner admits that "Groves does not disclose a receiver antenna and a single coaxial cable." The Examiner further points to Kain asserting that "Kain et al. discloses another system for enhancing navigation system, comprising: a GPS receiver antenna and a single coaxial cable (Kain et al., figure 3, GPS antenna 48; Figure 2, cable 86; column 7, lines 40-41)."

With respect to independent claim 1, the claim is patentable over Groves in view of Kain et al. because these reference, either alone or in combination, fail to teach or suggest all the limitations of Claim 1. In particular, Groves in view of Kain et al. fails to teach "the single coaxial cable simultaneously supplying direct current (DC) power to the IMU and transmitting the RF position data and the IMU data to the processor" as provided in Claim 1.

Groves is drawn to "methods of integrating INS and GPS data in order to provide more accurate navigation solutions." Groves, par. [0001]. Groves further provides "[a]n INS comprises a set of accelerometers and gyroscopes, known as an inertial measurement unit (IMU), together with a navigation equations processor, which integrates the IMU outputs to give the position, velocity and attitude. GPS consists of a constellation of satellites which transmit navigation data to a GPS receiver" Groves, par. [0002], lines 1-6. Groves further explains "[i]ntegrating INS and GPS together provides a navigation solution which combines the long

term accuracy of GPS with the continuity, high bandwidth and low noise of INS.” Groves, par. [0003]. Kain et al. is drawn to a “GPS receiver 46 is connected by a coaxial cable to GPS antenna 48.” Kain et al., col. 7, lines 40-41.

As admitted by the Examiner, Groves does not disclose a single coaxial cable simultaneously supplying direct current (DC) power to the IMU and transmitting the RF position data and the IMU data to the processor. What the Examiner has overlooked is that Kain et al. fails to cure this defect of Groves. Kain et al. either alone or in combination with Groves does not teach or suggest that the coaxial cable between GPS receiver 46 and GPS antenna 48 could simultaneously be used for supplying direct current (DC) power to the IMU, as provided by Claim 1. Nor does Kain et al. either alone or in combination with Groves teach or suggest that the coaxial cable between GPS receiver 46 and GPS antenna 48 could simultaneously be used for transmitting the RF position data and the IMU data to the processor, as provided by Claim 1. Groves and Kain et al., either alone or in combination, fail to provide an enabling description that enables a “single coaxial cable simultaneously supplying direct current (DC) power to the IMU and transmitting the RF position data and the IMU data to the processor” as provided in Claim 1.

In contrast to both Groves and Kain et al., the present application teaches: “[t]he present invention preferably leverages frequency separation and modulation techniques to combine, transmit and separate the several “signals” sharing the same cable.” Specification, par. [0013]. In other words, IMU signals, GPS signals and DC power share the combination power and data cable in different frequency bands. More specifically, the present application further teaches: “[a]t a high level, the present invention operates to modulate IMU data by a carrier whose center frequency is much lower compared to GPS frequencies (e.g., L1/L2) to avoid interference with the GPS RF data. The IMU data is extracted at the receiving end by band-pass filtering and signal processing. In a similar fashion, the DC power is extracted near the MEMS IMU by low-pass filtering.” Specification, par. [0013]. Thus, “while DC power is being provided to MEMS IMU 24, data from both MEMS IMU 24 and GPS antenna 22 is being simultaneously transmitted

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across the same cable and received at processor 12. By selecting the appropriate filtering frequencies and demodulating techniques, **processor 12 can thus receive discernable GPS RF data (e.g., L1/L2) and IMU data over the same cable that powers the IMU itself.**"

Specification, par. [0016]

Because, Groves and Kain et al., either alone or in combination fail to teach or suggest a "the single coaxial cable simultaneously supplying direct current (DC) power to the IMU and transmitting the RF position data and the IMU data to the processor" as provided in Claim 1 of the present invention, for at least that reason claim 1 is allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 2-7 either directly or indirectly depend on and further define Claim 1 and for at least that reason are also allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

CLAIM 8

Claim 8 was rejected under 35 USC § 103(a) as being unpatentable over Groves (U.S. Patent Publication No. 2004/0012522) in view of Sagem (EP Patent No. 820158A1). Applicant respectfully traverses this rejection.

As admitted by the Examiner, Groves does not disclose a single coaxial cable simultaneously supplying direct current (DC) power to the IMU and transmitting the RF position data and the IMU data to the processor. Respectfully, the Examiner has failed to demonstrate how Sagem cures this defect of Groves and thus has not established a *prima facie* case for obviousness.

Further, claims 8 directly depends on and further defines independent claim 1, which is allowable for the reasons provided above, and for at least that reason claim 8 is also allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

CLAIMS 9-20

Claims 9-19 were rejected under 35 USC § 103(a) as being unpatentable over Lin (U.S. Patent Publication No. 2002/0062193) in view of Lin (U.S. Patent Publication No. 2001/0020216). Applicant respectfully traverses this rejection.

The Examiner points to Lin (US '193) and asserts that it "discloses a system for powering and receiving data from remote equipment comprising: a GPS receiver (302) and Micro IMU (301) communicates with Kalman filter (303)." The examiner admits that "Lin fails to show a power and data cable in communication with a processor." The Examiner further points to Lin (US '216) asserting that it "cure[s] the deficiencies of Lin (US '193) by disclosing another system for power and receiving data from remote equipment comprising: a RS-232, as illustrated in page 11, paragraph 0204, as being a power and data cable used in transmitting data and power between devices."

Claims 9-15

With respect to independent claim 9, the claim is patentable over Lin (U.S. '193) in view of Lin (U.S. '216) because these reference, either alone or in combination, fail to teach or suggest a "filter configured to pass DC power from the combination power and data cable to the MEMS IMU and to preclude DC power from reaching the GPS receiver antenna; the filter further configured to pass IMU data generated by the MEMS IMU and received GPS radio frequency energy to the combination power and data cable" as provided by amended claim 9 of the present application.

Lin (U.S. '193) is drawn to "a micro IMU 301, a GPS receiver 302, and a database. The inertial measurement from an IMU is fused with the observables from a GPS receiver to deliver precise position data in a Kalman filter 303." Lin, U.S. '193 par. [0149]. Lin (U.S. '216) is drawn to a "central navigation Kalman filter 803 is microprocessor, which is connect with the GPS digital signal processing unit 802 and the interfaces 804 and the IMU data sampling circuit 806, to process the GPS measurements [from] the GPS digital signal processing unit 802 and IMU measurements from the IMU data sampling circuit 806." Lin U.S. '210 par. [0202].

Lin (U.S. '193) in view of Lin (U.S. '216), either alone or in combination, fail to teach or suggest providing DC power to the MEMS IMU by passing DC power received from the power and data cable through a filter, wherein the filter further blocks that DC power from reaching the GPS receiver antenna. Instead, Lin (U.S. '193) in view of Lin (U.S. '216) provides a Kalman filter – a digital filter algorithm executed on a microprocessor – that receives digital GPS and IMU measurements to calculate a navigation solution. See Lin, U.S. '216 par. [0193]. The teachings of Lin (U.S. '193) in view of Lin (U.S. '216) do not provide anything in their descriptions that would enable passing DC power from a cable to an IMU device through a digital filter algorithm such as a Kalman filter.

In contrast to Lin (U.S. '193) and Lin (U.S. '216), the present application teaches: “[t]he present invention preferably leverages frequency separation and modulation techniques to combine, transmit and separate the several “signals” sharing the same cable.” Specification, par. [0013]. In other words, IMU signals, GPS signals and DC power share the combination power and data cable in different frequency bands. More specifically, the present application further teaches: “[a]t a high level, the present invention operates to modulate IMU data by a carrier whose center frequency is much lower compared to GPS frequencies (e.g., L1/L2) to avoid interference with the GPS RF data. The IMU data is extracted at the receiving end by band-pass filtering and signal processing. In a similar fashion, the DC power is extracted near the MEMS IMU by low-pass filtering.” Specification, par. [0013]. Thus, “while DC power is being provided to MEMS IMU 24, data from both MEMS IMU 24 and GPS antenna 22 is being simultaneously transmitted across the same cable and received at processor 12. By selecting the appropriate filtering frequencies and demodulating techniques, processor 12 can thus receive discernable GPS RF data (e.g., L1/L2) and IMU data over the same cable that powers the IMU itself.” Specification, par. [0016]

Because, Lin (U.S. '193) and Lin (U.S. '216), either alone or in combination fail to teach or suggest a “filter configured to pass DC power from the combination power and data cable to

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the MEMS IMU and to preclude DC power from reaching the GPS receiver antenna” as provided in the amended claim 9 of the present application, for at least that reason claim 9 is allowable.

Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 10-15 either directly or indirectly depend on and further define claim 9 and for at least that reason are also allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 16-20

With respect to independent claim 16, the claim is patentable over Lin (U.S. ‘193) in view of Lin (U.S. ‘216) because these reference, either alone or in combination, fail to teach or suggest a first subsystem that includes “a first filter configured to pass DC power to the single coaxial cable; and a second filter configured to process GPS radio frequency energy and IMU data received from the single coaxial cable” and a second subsystem that includes “a third filter configured to send DC power from the single coaxial cable to the MEMS IMU and to send MEMS IMU data and GPS radio frequency energy to the processor through the single coaxial cable” as provided by amended claim 16 of the present application.

Lin (U.S. ‘193) is drawn to “a micro IMU 301, a GPS receiver 302, and a database. The inertial measurement from an IMU is fused with the observables from a GPS receiver to deliver precise position data in a Kalman filter 303.” Lin, U.S. ‘193 par. [0149]. Lin (U.S. ‘216) is drawn to a “central navigation Kalman filter 803 is microprocessor, which is connect with the GPS digital signal processing unit 802 and the interfaces 804 and the IMU data sampling circuit 806, to process the GPS measurements [from] the GPS digital signal processing unit 802 and IMU measurements from the IMU data sampling circuit 806.”

Lin (U.S. ‘193) in view of Lin (U.S. ‘216), either alone or in combination, fail to teach or suggest providing DC power to the MEMS IMU by passing DC power received from the power and data cable through a filter, wherein the filter further blocks that DC power from reaching the GPS receiver antenna. Instead, Lin (U.S. ‘193) in view of Lin (U.S. ‘216) provides a Kalman filter – a digital filter algorithm executed on a microprocessor – that receives digital GPS and

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IMU measurements to calculate a navigation solution. See Lin, U.S. '216 par. [0193]. The teachings of Lin (U.S. '193) in view of Lin (U.S. '216) do not provide anything in their descriptions that would enable passing DC power from a cable to an IMU device through a digital filter algorithm such as a Kalman filter.

In contrast to Lin (U.S. '193) and Lin (U.S. '216), the present application teaches: “[t]he present invention preferably leverages frequency separation and modulation techniques to combine, transmit and separate the several “signals” sharing the same cable.” Specification, par. [0013]. In other words, IMU signals, GPS signals and DC power share the combination power and data cable in different frequency bands. More specifically, the present application further teaches: “[a]t a high level, the present invention operates to modulate IMU data by a carrier whose center frequency is much lower compared to GPS frequencies (e.g., L1/L2) to avoid interference with the GPS RF data. The IMU data is extracted at the receiving end by band-pass filtering and signal processing. In a similar fashion, the DC power is extracted near the MEMS IMU by low-pass filtering.” Specification, par. [0013]. Thus, “while DC power is being provided to MEMS IMU 24, data from both MEMS IMU 24 and GPS antenna 22 is being simultaneously transmitted across the same cable and received at processor 12. By selecting the appropriate filtering frequencies and demodulating techniques, processor 12 can thus receive discernable GPS RF data (e.g., L1/L2) and IMU data over the same cable that powers the IMU itself.” Specification, par. [0016]

Because, Lin (U.S. '193) and Lin (U.S. '216), either alone or in combination fail to teach or suggest a “first filter configured to pass DC power to the single coaxial cable; and a second filter configured to process GPS radio frequency energy and IMU data received from the single coaxial cable” and “a third filter configured to send DC power from the single coaxial cable to the MEMS IMU and to send MEMS IMU data and GPS radio frequency energy to the processor through the single coaxial cable” as provided in the amended claim 16 of the present application,

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for at least that reason claim 16 is allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

Claims 17-20 either directly or indirectly depend on and further define claim 9 and for at least that reason are also allowable. Reconsideration and withdrawal of this rejection is respectfully requested.

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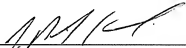
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CONCLUSION

Applicant respectfully submits that claims **1-20** are in condition for allowance and notification to that effect is earnestly requested. If necessary, please charge any additional fees or credit overpayments to Deposit Account No. 502432.

If the Examiner has any questions or concerns regarding this application, please contact the undersigned at 612-455-1687.

Respectfully submitted,

Date: 9/26/2006

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